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LESPEDEZA IN ILLINOIS

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FOREWORD

THE IMPORTANCE of legumes in a system of permanent fertility was early demonstrated by the Illinois Agricultural Experiment Station and recognized by Illinois farmers. One of the problems with the better known legumes—alfalfa, sweet clover, and red clover—has been to obtain satisfactory growth on soils that have reached a low level of productivity. Changing economic conditions have intensified this problem by making it difficult for many farmers to purchase sufficient amounts of soil-building materials to insure reasonable success with these legumes.

Among many legumes tested at this Station, lespedeza has been found to have outstanding merit, especially for its ability to grow under conditions unfavorable to other legumes, thus enabling a farmer to set in motion the process of soil improvement without making a large initial outlay for fertilizing materials. The prospect is that lespedeza will become one of the important legume crops of the state. The extent to which this will occur will depend upon those interested gaining a better understanding of its culture and utilization and upon the development of varieties still better adapted to the wide range of soil and climatic conditions in the state.

H. W. MUMFORD
Director

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Urbana, Illinois July, 1935

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LESPEDEZA IN ILLINOIS

By J. J. Pieper, O. H. Sears, and F. C. Bauer[a]

LESPEDEZA is a comparatively new crop in Illinois. It was introduced after a vigorous search for a legume that would be better adapted to the rapidly increasing areas of acid and depleted soils in the state than other legumes previously grown.

This new legume is not expected to replace other well-known legumes, but to make it possible to grow larger acreages of legumes. To farmers who have not succeeded in growing satisfactory crops of alfalfa, sweet clover, and red clover, or who desire a legume more tolerant to acid soils, lespedeza offers new possibilities. It will fit into many Illinois farming systems because of its value as a hay and pasture crop, its relative tolerance to soil acidity and resistance to drouth, its relative freedom from insects and disease pests, and its low cost of seeding. These characteristics and the fact that it is a warm-weather crop make lespedeza ideally adapted to conditions in southern Illinois. Thruout the southern third of the state it is rapidly becoming the principal legume on many farms, while farther north it is supplementing clovers and alfalfa.

Tho sometimes called a clover, lespedeza is not a clover any more than are cowpeas, soybeans, or alfalfa. It does, however, belong to the legume family and as such has valuable soil-enrichment properties and high feeding value.

Since the Illinois Agricultural Experiment Station began to conduct experiments with lespedeza thirteen years ago, the areas sown to this crop in Illinois have increased to more than 100,000 acres, and today lespedeza must be ranked with the important legumes of the state. This publication reports the results of experiments with lespedeza made on experiment fields of various soil types thruout Illinois from 1922 until the present time (Fig. 1).

DESCRIPTION AND HISTORY OF VARIETIES

Annuals Are More Important in Illinois

Five distinct commercial varieties of annual lespedezas are now available in the United States. Three of these—Common, Tennessee

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76, and Kobe—belong to the species *Lespedeza striata,* and two of them—Korean and Harbin—belong to the species *Lespedeza stipulacea.* A number of other annual strains which are not commercially available are being tested.

The annual lespedezas are small-branched plants which grow either erect or spreading. Under the best conditions they attain a height of 30 to 36 inches, but more often growth ranges from 5 to 15

FIG. 1.—LOCATION OF EXPERIMENT FIELDS ON WHICH LESPEDEZA TESTS HAVE BEEN MADE

These twenty-five experiment fields may be considered representative of the wide range of soil and climatic conditions that are found in Illinois.

inches. The small, numerous leaves are trifoliate as they are in the clovers. The fibrous roots are medium-deep but numerous. The small, inconspicuous purple flowers are borne on short stems in the axils of the leaves. Blooming occurs from midsummer to early fall. The dark purple seeds are about the size of red-clover seed and are borne singly in pods, in which they are retained when threshed. The size of the seed and the size of the calyx lobes, which

partially enclose the brown hulls, vary with the variety and form a basis for distinguishing one variety from another (Fig. 2).

Common. Sometime prior to 1846 a new legume was introduced

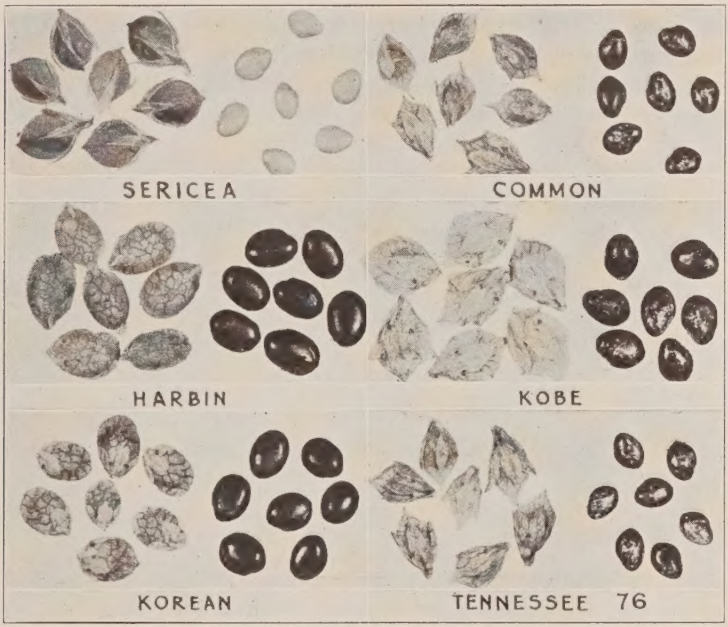

FIG. 2.—SEED CHARACTERISTICS THAT DISTINGUISH DIFFERENT VARIETIES OF LESPEDEZA

Sericea has a reddish brown hull, at the base of which is attached the lighter colored calyx, which divides into five sharp lobes or sepals extending about half the length of the seed. The seed is light green, usually sold with hull removed. **Harbin** has a distinctly netted brownish gray hull. The sepals are often broken off on threshing, but when present extend less than half the length of the seed. The seed is dark purple, usually sold in the hull. **Korean** has a grayish hull and a dark purple seed similar in appearance to Harbin. It is sold in the hull. **Common** is enclosed in a reddish gray hull, which is retained on threshing. The calyx lobes extend more than half the length of the seed and adhere tightly to the hull. The hulled seed is dark purple with light irregular blotches and is much smaller than Korean. **Kobe** has a gray hull with calyx lobes extending more than half the length of the seed. The unhulled seed is somewhat larger than that of other varieties; the hulled seed is reddish purple with greenish gray blotches and is larger than Common. The seed is sold in the hull. **Tennessee 76** has a reddish gray hull with calyx lobes extending more than half the length of the seed. The hulled seeds are similar in size and color to those of Common. The seed is sold in the hull.

into the cotton belt of the United States from Japan, which later became known as Japan clover or Common lespedeza. It grew wild and soon spread thruout the South, becoming popular as an acid-tolerant legume well adapted to poor land. It was first observed in Illinois about twenty-five years ago and its worth as a forage crop recognized by some farmers; because of its small growth, however, it was given very little attention until recently. At the present time Common lespedeza is widely distributed over the southern third of Illinois and has produced sufficient seed, even in central Illinois, to

FIG. 3.—CHARACTERISTIC GROWTH OF COMMON LESPEDEZA IN A THIN STAND

Common lespedeza has a decumbent or prostrate habit of growth where the stand is thin. Where the stand is thick, however, it tends to grow more nearly erect.

maintain a stand. It grows erect in thick stands but spreads out on the ground when stands are thin (Fig. 3). In thin stands the plant branches freely. It seldom reaches a height of more than 5 or 6 inches. The seeds are produced in the axils of the leaves along the stems.

Tennessee 76. From the Common lespedeza a superior strain, now known as Tennessee 76, was selected by the Tennessee Agricultural Experiment Station[3*] in 1915. This strain grows tall and erect and produces more hay than Common lespedeza. It is slightly later than Common and in Illinois it has not been as good a seed producer as Common or Kobe.

Kobe. Kobe lespedeza was first grown in South Carolina from seed obtained in 1919 from near Kobe, Japan. It is slightly earlier

than the Common lespedeza but considerably later than Korean. In thick stands it grows erect; otherwise it has a spreading habit of growth. It grows larger and coarser than Common. In Illinois the seed yields have been similar to those of Common but not so large as those of Korean.

Korean. Another annual species of lespedeza was introduced into this country from Korea in 1919 by the U. S. Department of Agriculture. It was given the name Korean. The young plants grow more rapidly in the spring than do those of the other annual varieties

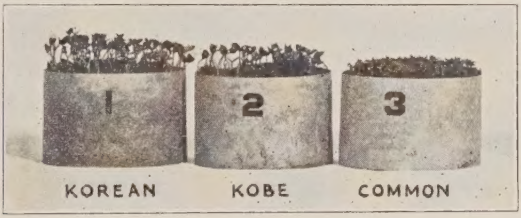

FIG. 4.—KOREAN LESPEDEZA STARTS GROWTH EARLY IN THE SPRING

The samples of spring growth of the three lespedezas shown above were obtained from the Urbana field on April 19, 1933, by pressing open cylinders into the soil and removing them with soil and plants intact. In these volunteer seedings Korean germinated earlier and grew more rapidly in the spring than Kobe or Common. Korean is also earlier than Tennessee 76.

FIG. 5.—KOREAN LESPEDEZA GROWING IN A THIN STAND (LEFT) AND IN A THICK STAND (RIGHT)

The growth habit of Korean lespedeza is influenced greatly by thickness of stand. When the growth is thin, a single plant may spread over an area 2 to 3 feet in diameter. When the stand is thick, a plant forms a single upright stem with but few branches.

(Fig. 4). Korean blooms two weeks earlier and matures seed almost a month before the other annuals. In thin stands it produces a spreading growth but in a thick stand it grows erect (Fig. 5). It is leafy, and the dense foliage is retained long after the plants are mature (Fig. 6). This species is a very good seed producer, leading all other annual varieties.

FIG. 6.—KOREAN LESPEDEZA IN ACTIVE GROWTH STAGE

The value of Korean lespedeza for pasture and hay is due to its fine stems and leafy nature, which make for little waste when fed. The plants above were photographed August 10, 1934, at Urbana. Korean retains its leaves late in the fall, making it valuable for winter pasture.

Harbin. The most recently introduced annual lespedeza came from a Russian cemetery at Harbin, Manchuria. It was discovered and introduced into the United States in 1929 by the U. S. Depart-

ment of Agriculture. Two strains have been selected from this variety—Strain 65280, sold commercially as Harbin, and Strain 59379, which is slightly larger and a few days later in maturity. Both these strains belong to the same species as Korean. Harbin is the earliest commercial strain in the United States. Like Korean, Harbin has a more or less spreading habit of growth, except when grown in thick stands. It is somewhat smaller than Korean. It is an excellent seed producer and promises to extend the lespedeza region at least 200 miles farther north.

Sericea a Promising New Perennial

A perennial species of lespedeza now known as Sericea (*Lespedeza sericea*), Strain 12087, was introduced from Japan by the U. S. Department of Agriculture in 1925. Later it was learned that an intro-

FIG. 7.—SERICEA LESPEDEZA GROWING IN ROWS 30 INCHES APART

When grown for seed production, Sericea lespedeza is sown in rows, as shown above, and reaches a height of 3½ to 4 feet. It produces a thick stand of good hay when seeded solid.

duction of Sericea, Strain 04730, had been made twenty years earlier. Some of the plants from this earlier introduction were still growing on the government experiment farm near Washington, D. C., when the second introduction was made.

Sericea was hailed as a great find because it is a perennial

lespedeza, yet curiously enough all but two of the known 124 species of lespedezas in the world are perennial. Seventeen of these are to be found growing wild in the United States and about ten of them in Illinois.

Sericea grows larger than the annual types,[5,11*] and may produce as many as a hundred stems to a crown (Fig. 7). Altho Sericea resembles alfalfa in some respects, it is easily distinguished by its small leaves, its inconspicuous yellow or purple flowers, and its dense foliage. It has not increased so rapidly in the United States as have the annual lespedezas because of the high price of the seed, the difficulty of establishing a stand, and the coarseness of the perennial plant.

PLACE OF LESPEDEZA IN ILLINOIS AGRICULTURE

Has Wide Use as a Pasture Crop

Lespedeza finds its widest use in Illinois as a pasture crop, seeded either alone or in mixtures (Fig. 8). It makes its best growth during

FIG. 8.—PASTURING BEEF CATTLE ON LESPEDEZA

Lespedeza finds its widest use as a pasture crop. It thrives in hot weather and makes its greatest growth during the summer months when pasture grasses are more or less dormant.

the summer months and provides good grazing at a time when other pasture crops are the least productive. When sown alone, it may be pastured by the first of July. Korean, which does not lose its leaves readily even when mature, may be pastured as late as December. Other varieties furnish good pasture until killing frost.

The amount of grazing furnished by lespedeza is dependent upon the productiveness of the soil, seasonal conditions, particularly rainfall, and upon pasture management. Even tho lespedeza grows upon poor soils and is drouth-resistant, the best results are obtained on good soils and with a favorable amount and distribution of rainfall.

Observations in Kentucky[6]* indicate that lespedeza pastures on soils of medium productivity will carry 1,000 pounds of livestock an acre for a period of 120 days, while on the more fertile fields twice this amount of livestock can be carried in favorable seasons. Etheridge *et al*[4]* state:

"At the Missouri Experiment Station, in the summer of 1928, a volunteer growth of Korean lespedeza, reseeded from a stand sown in the spring of 1927, was pastured in order to learn its carrying capacity and its ability to reseed under close grazing. Three two-year-old heifers, each weighing about 800 pounds, were carried on three-fourths of an acre without supplementary feed. They gained a total of 240 pounds over a period of 122 cattle days. In 1929 two yearling heifers, each weighing 581 pounds, grazed from July 1 to September 4 on the volunteer stand produced by the natural reseeding of 1928. For this period of 132 cattle days, the heifers made a total gain of 137 pounds or 1.04 pounds daily per head from three-fourths of an acre of pasture."

"At Sni-A-Bar Farm, Grain Valley, Missouri, 12 yearling heifers were placed on 10 acres of lespedeza for a period of seven weeks from July 15 to September 2. They made a total gain of 706 pounds or an average daily gain of 1.2 pounds in this period. The stand of lespedeza was very dense and the cattle did not consume more than half of it. There were also 430 ewes and 270 lambs in this field on 10 different days earlier in the season. Finally a seed crop of about 400 pounds to the acre was harvested."

Hogs and chickens do well when pastured on lespedeza, and recent trials at the Illinois Agricultural Experiment Station indicate that it is highly productive as sheep pasture.

When early pasture is desired, lespedeza may be seeded in rye or with oats or barley. These grain crops make excellent early pasture, and after they are gone the lespedeza is large enough to afford satisfactory grazing.

When seeded with sweet clover either in the original seeding or in the spring of the second year's growth, lespedeza furnishes excellent grazing by the middle of July, when sweet clover no longer provides succulent forage. The following year a stand of self-seeded lespedeza will appear which may contain volunteer sweet clover as well.

The seeding of lespedeza in redtop or in timothy for either meadow or pasture improves both the quality and the quantity of the forage produced. Furthermore lespedeza makes most of its growth when

the grass crops are less abundant. Lespedeza may be used to thicken a thin stand of bluegrass sod.

Altho lespedeza may be grazed too heavily to provide a maximum number of pasture days, it is practically impossible for the animals to graze it so close as to prevent seed formation. The lespedeza field shown in Fig. 9 was grazed nearly to the ground, yet each plant matured three to twelve seeds.

FIG. 9.—A LESPEDEZA FIELD HEAVILY GRAZED BY CATTLE

In areas where Korean lespedeza matures seed, it is practically impossible to graze it sufficiently close to prevent seed formation. In the above field the lespedeza was eaten nearly to the ground, being less than 2 inches high in October, yet each plant matured three to twelve seeds.

Bloat is always a problem to consider in pasturing any new legume, but limited experience of farmers indicates that lespedeza is less apt to cause bloat or indigestion either with cattle or sheep than are the other legumes. It is always a wise precaution to give the animals a full feed before they are turned onto the lespedeza and then to keep them on lespedeza pasture once they have started grazing on it.

Some Illinois farmers have reported that lespedeza causes horses to slobber. While this observation is authentic, there is no reason to believe that this effect is general, for many farmers have never observed such a condition. It is believed that the tendency toward slobbering decreases after the horses have become accustomed to the pasture, particularly if they have access to salt.

Furnishes Hay of High Quality

Lespedeza furnishes a hay of good quality on soils where alfalfa and red clover are unadapted or perhaps uncertain crops. Tho the lespedezas differ somewhat among themselves in composition, as shown in Table 1, they are all nearly if not equal in value to the other legume hays, whether judged on composition, on palatability, or on results from feeding trials.

In a feeding trial with fattening steers at the Illinois Station, Korean lespedeza proved superior to alfalfa and soybean hay with respect to rate of gain, cost of gain, dressing percentage, and quality of meat.[15]* From this experiment it was concluded that "the southern corn belt has a promising new hay crop for cattle feeders in the form of Korean lespedeza." Even the threshed straw of Korean lespedeza is a source of good roughage.[12]* It retains a considerable portion of the leaves, even after threshing, and tests with dairy cows show that the threshed straw is only slightly inferior to soybean hay in feeding value (Table 2).

Altho animals refuse but little of the annual lespedeza hays, the stems of the perennial Sericea are somewhat coarser and are not so

TABLE 1.—COMPOSITION OF LESPEDEZA AND OTHER LEGUME HAYS[a]

Crop	Moisture	Ether extract	Protein	Crude fiber	Ash
	perct.	*perct.*	*perct.*	*perct.*	*perct.*
Alfalfa	8.6	2.3	14.9	28.3	8.6
Red clover	12.9	3.1	12.8	25.5	7.1
Soybeans	8.6	2.8	16.0	24.9	8.6
Lespedeza					
Common	11.8	2.8	12.1	25.9	5.8
Korean	7.2	3.3	16.2	26.0	7.4
Sericea	5.9	1.8	12.3	30.1	6.0

[a]Data are compiled from various sources.

TABLE 2.—FEEDING VALUE OF LESPEDEZA STRAW AND SOYBEAN HAY[a]

Kind of feed	Number of cows	Feed consumed daily per cow			Gain daily per cow	Test of milk	Milk yield daily per cow
		Silage	Straw or hay	Grain			
		lbs.	*lbs.*	*lbs.*	*lbs.*	*perct.*	*lbs.*
Lespedeza straw	18	28.4	12.0	12.8	.37	3.71	33.5
Soybean hay	18	28.4	12.8	12.8	.08	3.78	35.5

[a]From an experiment reported by Nevens,[12]* Illinois Agricultural Experiment Station.

completely consumed. All but the coarsest stems, however, are eaten. The proportion of coarse stems is dependent to a considerable extent upon the stage of growth at which the hay is harvested.

Seed Provides a Cash Crop

The production of lespedeza seed has been more profitable during the last six or eight years than it is likely to be in the future. An increasing amount of seed grown both for home consumption and for the general seed trade has resulted in a steady decline in price during the last five years. Three factors have contributed to the

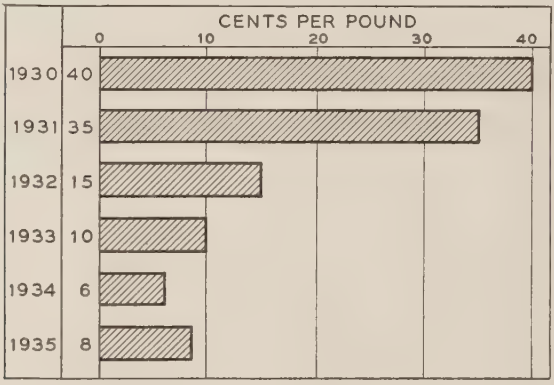

FIG. 10.—RETAIL PRICES OF KOREAN LESPEDEZA SEED

The rapid price decline of lespedeza seed during the period 1930-1935 with the increase in supplies of seed available is characteristic of any promising new crop.

increased production and the resulting lower prices: (1) a market sufficiently high to stimulate seed production, (2) relatively high seed yields per acre, and (3) ease of harvesting seed.

Retail prices for the Korean variety from 1930 to 1935 indicate the downward trend in price as the crop became established (Fig. 10). The price of Sericea has shown even more marked changes. In 1932 seed sold as high as $25 a pound, whereas in 1933 it sold as low as 25 cents a pound.

The present low price of lespedeza seed compared with other legumes is one of the reasons for the popularity and economy of this crop. Not only is the initial seed cost an acre usually lower than that of the legumes commonly grown, but one seeding is usually sufficient for several years' growth.

Valuable for Soil Improvement and Conservation

Lespedeza is so new as an Illinois crop that it is not yet possible to appraise fully its soil-improvement value, tho its habits of growth, its composition, and other characteristics suggest that it will rank high in this respect.

When nodulated, lespedeza acquires a considerable portion of its nitrogen from the air and its mineral nutrients from less readily available sources in the soil, as do other legumes. In adapted regions lespedeza will grow on soils of lower fertility levels than will the biennial and perennial legumes frequently used for soil-improvement purposes. These characteristics make lespedeza especially valuable for soil improvement. Lespedeza yields on three fields in southern and south-central Illinois are shown in Table 3.

TABLE 3.—ACRE-YIELDS OF KOREAN LESPEDEZA HAY SPRING-SEEDED WITH SWEET CLOVER IN WHEAT ON UNLIMED AND LIMED LAND OF LOW PRODUCTIVITY, THREE-YEAR AVERAGE, 1932-1934

Field and soil	Soil-acidity factors			Acre-yields[b]	
	Reaction	Degree of saturation[a]	Lime requirement	Wheat	Lespedeza hay
Unlimed land					
Newton, south-central Illinois	*pH*	*perct.*	*tons*	*bu.*	*lbs.*
Mature flat gray prairie	4.9	17	5	2.1	127
Unionville, southern Illinois					
Mature rolling yellow land	5.2	28	4	7.6	478
Elizabethtown, southern Illinois					
Mature yellow hill land	5.3	35	3	5.2	872
Limed land					
Newton					
Mature flat gray prairie	6.3	77	0	18.4	1 955
Unionville					
Mature rolling yellow land	6.9	83	0	18.4	1 006
Elizabethtown					
Mature yellow hill land	6.7	92	0	16.6	1 817

[a]Percentage of total base-exchange capacity of soil satisfied with calcium and magnesium. When this value is lower than 70 to 80 percent, the soil is in need of lime. The lower this percentage, the greater is the need for lime. [b]Sweet clover failed to grow on the unlimed land. The limed plots produced a good growth of sweet clover in addition to the wheat and lespedeza.

Good Source of Organic Matter.—Under favorable conditions lespedeza will produce considerable quantities of organic matter the same year that it is seeded (Table 4), which may be utilized as green

manure. Like most annual legumes, the amount of organic matter in the roots of lespedeza is comparatively small. If allowed to self-seed, increasing yields of organic matter may be expected for several years at least (Tables 5 and 6). A number of Illinois orchardists

TABLE 4.—ACRE-YIELDS OF DRY MATTER PRODUCED BY KOREAN LESPEDEZA[a] IN WINTER WHEAT, SPARTA EXPERIMENT FIELD, SEPTEMBER, 1934
(Southern Illinois, light-colored soil of low productivity)

Soil treatment	Tops and roots of plant	Tops of plant		Roots of plant	
	lbs.	*lbs.*	*perct.*	*lbs.*	*perct.*
None	Trace	Trace	Trace	Trace	Trace
Limestone	2 418	2 140	88.5	278	11.5
Limestone, phosphorus	2 311	2 048	88.6	263	11.4
Limestone, phosphorus, potash	2 072	1 823	88.0	249	12.0

[a]Lespedeza yields were apparently affected by the wheat yields which were 9, 21, 28, and 31 bushels an acre for the respective soil treatments.

TABLE 5.—ACRE-YIELDS OF HAY AND SEED FROM ORIGINAL SEEDING AND FROM SELF-SEEDING OF KOREAN LESPEDEZA IN WINTER WHEAT,[a] WEST SALEM EXPERIMENT FIELD, 1933 AND 1934
(Southern Illinois, rolling yellow soil of low productivity)

Soil treatment	Original seeding		Self-seeding	
	Hay yields	Seed yields	Hay yields	Seed yields
	lbs.	*lbs.*	*lbs.*	*lbs.*
None	77	[b]	177	14
Limestone, 4 tons in 1912	325	[b]	1 068	86
Limestone, 8 tons;[c] crop residues[d]	1 650	[b]	3 405	202
Limestone, 8 tons; manure	1 717	[b]	4 359	491

[a]The 1933 yields of wheat on respective plots were 1.2, 11.3, 16.9, and 21.1 bushels an acre. [b]Seed not harvested; left for reseeding. [c]Four tons in 1912 and at the annual rate of 1,000 pounds thereafter until a total of 8 tons was applied. [d]Includes sweet clover utilized as a green manure.

TABLE 6.—ACRE-YIELDS OF HAY AND SEED FROM REPEATED SELF-SEEDING OF KOREAN LESPEDEZA ON UNLIMED AND LIMED LAND, WEST SALEM, 1931-1934
(Southern Illinois, rolling yellow soil of low productivity uniformly treated with manure, phosphate, and potash)

Year	Hay yields		Seed yields	
	No limestone applied	8 tons limestone applied	No limestone applied	8 tons limestone applied
	lbs.	*lbs.*	*lbs.*	*lbs.*
1931	360	480	[a]	[a]
1932	[b]	[b]	22	385
1933	1 800	2 980	147	489
1934	3 886	4 917	233	413

[a]Seed crop not harvested in 1931, left for self-seeding. [b]Hay not harvested in 1932.

have used lespedeza successfully as a green-manure crop in peach and apple orchards.

The total amount of organic matter that may be obtained by growing lespedeza depends upon soil conditions (Tables 3 and 4), the varieties used (Tables 7, 8, and 13 to 15), and the cultural and treatment practices employed (Tables 13, 16, and 19 to 22).

TABLE 7.—ACRE-YIELDS OF HAY AND SEED OF TWO VARIETIES OF LESPEDEZA HARVESTED FROM ORIGINAL SEEDING AND FROM SELF-SEEDING, RALEIGH EXPERIMENT FIELD, 1933 AND 1934

(Southern Illinois, gray flat soil of low productivity but with good soil treatment)

Kind of seeding and year	Korean		Tennessee 76	
	Hay	Seed	Hay	Seed
	lbs.	*lbs.*	*lbs.*	*lbs.*
Original seeding 1933	1 238	200	1 800	23
Self-seeding 1934	3 635	178	2 804	18

TABLE 8.—ACRE-YIELDS OF HAY OF SEVERAL VARIETIES OF LESPEDEZA RESEEDED EACH YEAR ON THE ALEDO EXPERIMENT FIELD, 1932-1934

(Northern Illinois, dark-colored soil of high productivity)

Year	Korean	Tennessee 76	Kobe	Common
	lbs.	*lbs.*	*lbs.*	*lbs.*
1932	1 997	1 152	1 622	1 258
1933	2 486	1 238	1 114	662
1934	3 552	840	1 008	552

Increases Available Nutrient Elements.—Chemical analysis shows that lespedeza compares favorably with other legumes in nitrogen and mineral nutrient content (Tables 9 and 10). Correcting soil deficiencies before growing lespedeza increases the plants' content of the respective nutrient elements (Table 11). That the plowing under of lespedeza increases measurably the supply of nutrients available for succeeding crops is indicated by experiments reported from Tennessee, Kentucky, and North Carolina. In an experiment by the Tennessee Station[10*] covering a ten-year period, corn was grown after sweet clover, lespedeza, orchard grass, and corn. Following sweet clover the corn yields averaged 54.5 bushels an acre; following lespedeza, 48.3 bushels; following orchard grass, 44.1 bushels; and following corn, 31 bushels. The yield of corn was more than doubled

TABLE 9.—CHEMICAL ANALYSIS OF KOREAN LESPEDEZA AND SWEET CLOVER AT CARLINVILLE AND HARTSBURG EXPERIMENT FIELDS, 1924 AND 1925[c]

Field and crop	Nitrogen	Phosphorus	Calcium	Sulfur
Tops of plants				
Carlinville, south-central Illinois[a]	*perct.*	*perct.*	*perct.*	*perct.*
Lespedeza	1.88	.25	1.13	.30
Sweet clover	2.73	.20	1.35	.44
Hartsburg, north-central Illinois[b]				
Lespedeza	2.04	.27	1.30	.48
Sweet clover	2.72	.23	3.45	.42
Roots of plants				
Carlinville				
Lespedeza	1.33	.18	.40	.47
Sweet clover	2.45	.15	.57	.38
Hartsburg				
Lespedeza	1.09	.15	.35	.62
Sweet clover	2.00	.13	.72	.41

[a]Dark-colored soil of moderate productivity. [b]Dark-colored soil of high productivity. [c]Lespedeza was sampled in the fall (October, 1924) and sweet clover in spring (May, 1925).

TABLE 10.—AVERAGE COMPOSITION OF SOME COMMON LEGUMES
(Air-dry basis, pounds per ton)

Legume	Nitrogen	Phosphorus	Calcium	Magnesium
	lbs.	*lbs.*	*lbs.*	*lbs.*
Lespedeza	45.83	7.98	19.16	6.17
Alfalfa	52.08	4.76	22.26	8.00
Clover	40.00	5.00	29.25	13.84
Soybeans	43.40	4.74	27.56	7.75

TABLE 11.—COMPOSITION OF KOREAN LESPEDEZA HAY GROWN ON GRAY FLAT PRAIRIE SOILS OF SOUTHERN ILLINOIS WITH VARIOUS SOIL TREATMENTS

Soil treatment	Nitrogen	Phosphorus	Calcium	Magnesium
	perct.	*perct.*	*perct.*	*perct.*
None	1.92	.31	.71	.28
Residues, limestone	2.48	.37	1.06	.30
Residues, limestone, phosphorus	2.82	.43	1.07	.35
Residues, limestone, phosphorus, potassium	2.60	.44	1.10	.24

when preceded by lespedeza in experiments ranging from one to three years in Kentucky, Tennessee, and North Carolina.[9*]

Useful in Erosion Control.—Lespedeza has also proved of value in soil conservation. Its effective use in erosion control was demon-

strated in an experiment reported by Pieters[14*] in North Carolina. The water run-off from sloping land left bare and fallow was 26.2 percent of the annual rainfall; where lespedeza was grown, the run-off was only 10.7 percent. The run-off from the bare fallow land carried with it 64.79 tons of soil an acre; that from the land growing lespedeza only 2.2 tons. The ability to grow on soils of lower fertility levels, to

FIG. 11.—LESPEDEZA AIDS IN EROSION CONTROL

A fair stand of Korean lespedeza seeded on rather steep land along a public highway is shown above. Its ability to reseed and to grow more satisfactorily on lands of lower fertility than some of the other more commonly grown legumes makes lespedeza a promising plant for erosion control.

fill the surface soil with fibrous roots, and to self-seed successfully makes lespedeza an excellent crop for use in erosion control (Fig. 11).

Altho experimental evidence is yet somewhat meager with reference to the soil-improvement value of lespedeza, there is a rapidly growing volume of enthusiastic praise in the agricultural press from farmers. This praise, coupled with the various characteristics of lespedeza, has led Pieters[14*] to say, "If there is anything we know about lespedeza, it is that it will increase soil productivity."

Well Suited to Corn-Belt Rotations

Whether lespedeza is to be used for pasture, hay, seed, or soil improvement, this crop is readily adapted for use in many different

corn-belt rotations. Little, if any, change need be made in most cropping systems with respect to sequence or kind of crops in order to add lespedeza to the rotation.

The following rotations indicate the possible uses of lespedeza and may suggest other desirable combinations. It is impossible, of course, to recommend a single rotation that would be suitable for all areas.

In wheat-growing areas and in sections of Illinois where lespedeza produces seed sufficiently early to permit wheat sowing, both of these crops may be grown on the same land each year, thus furnishing two cash crops or a cash crop and a forage crop. When lespedeza is seeded in wheat, reseeding may not be necessary for two or three years because a large amount of seed remains in the soil from year to year. Lespedeza does not interfere with the wheat yield and may be harvested for forage or for seed. Wheat may be sown on the land again in the fall. The ground, under favorable weather conditions, may be prepared satisfactorily without plowing, merely by disking or even by drilling the wheat without special seed-bed preparation. This same system may be employed with any of the spring-seeded small grains.

Two-Year Rotations

Wheat or oats (lespedeza seed crop)	Corn
Lespedeza (hay, pasture, or seed)	Wheat or oats (lespedeza)

The lespedeza in the first rotation suggested above may be seeded in the wheat or oats and a crop of lespedeza seed, as well as a crop of grain, obtained the same year. In the second year a stand of lespedeza will be obtained without reseeding; this may be pastured or cut for hay, and in some sections a seed crop may be harvested before time for preparing for wheat.

In the second rotation above lespedeza seeded in the small grain crop may be used for hay, for seed, or for fall pasture. Thus three crops are obtained in two years. This rotation may be changed into a three-year rotation by allowing the lespedeza to occupy the land the year following the small-grain crop.

Three-Year Rotations

Corn	Corn
Oats or wheat (lespedeza)	Soybeans
Lespedeza	Wheat (lespedeza)

By pasturing or using the lespedeza for hay or seed for an additional year, the above three-year rotations can be converted into four-year rotations.

Four-Year Rotations

Corn	Corn	Corn
Oats	Soybeans	Oats (lespedeza)
Wheat (lespedeza)	Wheat (lespedeza)	Lespedeza
Lespedeza	Lespedeza	Wheat (lespedeza)

Five-Year Rotations

Corn	Corn	Corn
Oats (lespedeza)	Oats	Soybeans
Lespedeza	Wheat (lespedeza)	Wheat (lespedeza)
Wheat (lespedeza)	Lespedeza	Lespedeza
Lespedeza	Corn, or wheat (lespedeza)	Wheat (lespedeza)

Obviously four-year and five-year rotations are suited to areas where livestock is of major importance and where it is not so desirable to have a large proportion of the farm in corn.

A cropping system involving lespedeza and small grain has the following points to recommend it.

1. Two cash crops may be harvested annually.
2. Limited preparation of the seed bed for small grain is required.
3. There is a legume on the land every year.
4. The lespedeza reseeds itself each year.
5. There is a continuous cover crop on the land as an aid to erosion control.

Since lespedeza fits well into corn-belt rotations and has wide use as a pasture and hay crop, and since it may provide a cash crop or one for soil improvement and conservation, it is evident that it will find an important place in Illinois agriculture.

ADAPTATION OF LESPEDEZA

Climatic Limitations Few

Length of Growing Season Main Consideration.—The adaptation of lespedeza to an area is dependent primarily on the length of the growing season. It grows almost any place where the season is sufficiently long to allow for maturity. It is found in the United States from the Gulf of Mexico north to the Middle Corn Belt and from the Atlantic coast to the Great Plains area. There is no place in Illinois where some variety will not mature; the later varieties, however, will reseed only in the southern part of the state, where the growing season is longer.

More Drouth-Resistant Than Clovers.—Lespedeza is more drouth-resistant than are the common legumes such as sweet clover and red clover. Results secured on nine experiment fields in southern Illinois in 1931 and 1932 indicate that where seeded with sweet clover in either winter wheat or oats, lespedeza usually survived the drouth,

while sweet clover did not, and in all instances where both survived, lespedeza was injured less than the sweet clover.

Among a number of legumes sown alone on three southern Illinois experiment fields in 1931 and 1932, lespedeza was the only one

FIG. 12.—EFFECT OF MOISTURE CONDITIONS UPON GROWTH OF KOREAN LESPEDEZA

The two bunches of lespedeza shown above were grown in the same field only a few feet apart and under the same soil conditions except for a difference in moisture supply caused by a difference in topography. Tho drouth-resistant, the lespedeza on the left under unfavorable moisture conditions grew less than 8 inches tall; the lespedeza on the right under more favorable moisture conditions reached a height of more than 30 inches.

to survive during these seasons of drouth. Growth was, however, badly stunted by the dry weather. The term "drouth-resistant" as used here does not mean that the crop is unaffected by severe drouth conditions, but rather that it can survive in dry weather (Fig. 12). At

the Sparta experiment field on a part of the plot where moisture was abundant, the growth was much greater than where it was deficient. Poor yields resulted on the Alhambra field when rainfall was low during late summer and fall, yet the lespedeza survived and reseeded itself. Fall rains following a summer drouth gave high yields on the Urbana field in 1934 (Table 14, page 328).

FIG. 13.—EARLY GROWTH OF LESPEDEZA COMPARED WITH THAT OF OTHER LEGUMES

In a volunteer seeding, Korean lespedeza germinated as early and grew as rapidly in the seedling stages as any of the other legumes tested. The samples shown were taken from the field by pressing an open cylinder into the soil and removing plants and soil intact.

Continued wet weather in the spring will encourage "damping-off," a fungus disease of seedlings discussed on page 345. When cloudy, rainy weather continues for a long period in the fall, the entire lespedeza plant, except the tops which are exposed to the air, may mold badly if the stand is dense.

Sensitive to Low Temperatures.—Lespedeza is more easily injured by a killing frost in the fall than are such common legumes as red clover, sweet clover, and alfalfa. Korean, because of its earlier maturity, is less apt to be injured by frost than are the later varieties.

Lespedeza seedlings will not withstand so low a temperature in the spring as will red clover and alfalfa. Red clover and alfalfa seedlings are more resistant as they become older, while lespedeza seedlings become less resistant as they grow older. Sericea seedlings are the most resistant to low temperatures, and those belonging to the Korean species the least resistant.

Laboratory experiments by Tysdal and Pieters[16*] showed that water-soaked lespedeza seed is more resistant to freezing temperatures than is similarly treated alfalfa seed. This fact may account in part for the success of the plant in reseeding itself. Tests at the Illinois Station indicate that a volunteer seeding of lespedeza will usually germinate as early as will legumes now commonly grown (Fig. 13).

Lespedeza is a warm-weather plant and makes its most rapid growth during the warm season of the year.

Responds to Good Soils But Survives on Poor

Lespedeza tolerates more acidity, adjusts itself more easily to the lower levels of fertility, and withstands adverse drainage condi-

FIG. 14.—LIMESTONE HELPS BOTH LESPEDEZA AND SWEET CLOVER

Yields of Korean lespedeza and sweet clover at the Newton experiment field, south-central Illinois, from areas covering 4 square feet are shown above. With no limestone (0) the yield of lespedeza was small, and sweet clover failed completely. Three tons of limestone increased the yield of lespedeza materially (3), but sweet clover still failed to grow. The 6- and 12-ton applications increased the growth of sweet clover to a point where it began to smother the lespedeza and thus reduce the yields (6 and 12).

tions better than some of the other more commonly grown legumes. There are limits in all these directions, however, beyond which this plant does not readily adjust itself; when seeded on unfavorable soils, unsatisfactory growth will result unless the proper soil treatments are made.

Higher Acid-Tolerance Than Other Legumes.—Combined seedings of Korean lespedeza and sweet clover on highly acid soils of low productivity indicate that lespedeza is better adapted to such soils than is sweet clover. A combined seeding of these two legumes was made in winter wheat in the spring of 1934 at the Newton soil experiment field on land treated uniformly with phosphate and potash but with variable amounts of limestone. Without limestone sweet clover failed entirely and lespedeza grew very poorly. Where a total of 3 tons of limestone an acre had been applied over a period of twenty-three years, lespedeza grew luxuriantly but sweet clover still failed to grow. Where totals of 6 and of 12 tons of limestone had been applied, both legumes grew satisfactorily (Fig. 14).

Tho lespedeza will grow on acid soils, correspondingly better growth is made as acidity is lessened, as shown by experiments on soils of low productivity in southern and south-central Illinois (Table 3, page 313). Applications of limestone greatly improve the ability of these soils to grow lespedeza (Table 12).

TABLE 12.—ACRE-YIELDS OF HAY OF SEVERAL VARIETIES OF LESPEDEZA ON UNLIMED AND LIMED SOILS OF NATURALLY LOW PRODUCTIVITY IN SOUTHERN AND SOUTH-CENTRAL ILLINOIS, 1934

Field	Common		Kobe		Korean		Tennessee 76	
	Unlimed	Limed	Unlimed	Limed	Unlimed	Limed	Unlimed	Limed
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
West Salem	...	1 634	...	2 227	...	3 839	...	2 627
Sparta	75	348	106	439	85	1 650	581	1 462
Elizabethtown	...	1 278	...	954	...	1 826	...	1 775
Enfield	59	0	54	151	53	1 038	311	196
Oblong	...	.....	...	.....	...	3 428	...	2 531

Response to Fertility Levels.—Altho lespedeza thrives better than alfalfa, sweet clover, and red clover on soils of low fertility levels, it does best on soils that are maintained in a fair to good state of productiveness, as shown by the results obtained with sixteen crops grown on southern Illinois experiment fields from 1931 to 1934 (Fig. 15). The lands maintained at the higher fertility levels tended to produce the largest yields; as the fertility levels declined the yields

also declined. The presence or absence of calcium, as influenced by the use of limestone on the acid soils, was the most important factor in the growth of lespedeza. Applications of phosphorus and potassium

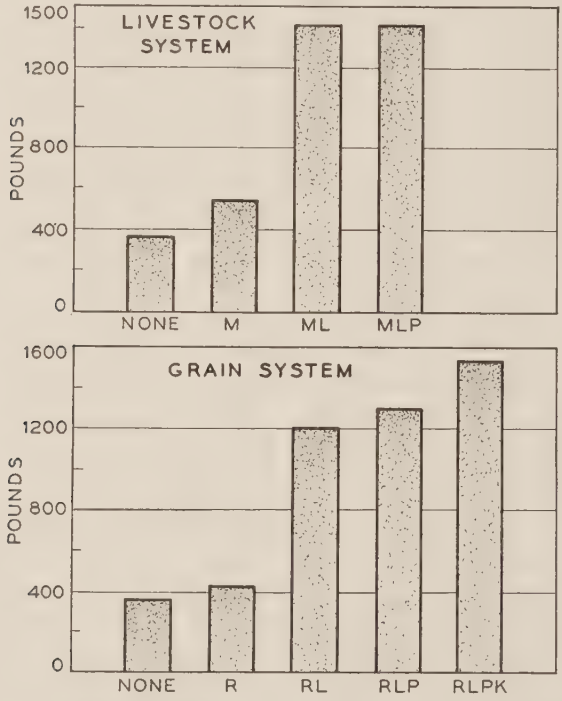

FIG. 15.—EFFECT OF SOIL PRODUCTIVITY ON YIELDS OF LESPEDEZA HAY

These charts show the results obtained with 16 crops of lespedeza seeded in the spring in winter wheat on experiment fields in the southern third of Illinois during the years 1931 to 1934. The soils on these fields have been maintained at various fertility levels for approximately twenty years. Yields varied greatly according to the soil treatment applied, the response to limestone being especially marked. (M = manure; L = limestone; P = phosphate; K = potash; and R = crop residues.)

fertilizers and organic matter also influenced the growth of lespedeza but to a lesser extent than the use of limestone.

Fair stands and growth of lespedeza on soils in advanced stages of erosion have led some observers to conclude that lespedeza will make a satisfactory growth on the poorest of soils. As a matter of fact, however, eroded soils may be in a higher state of productiveness

than is indicated by their appearance. On the Elizabethtown experiment field, for example, which is subject to serious erosion and has the appearance of a badly depleted soil, lespedeza will grow with fair success without soil treatment. On the Newton field, on the other hand, which does not present such a worn-out appearance, it is impossible to get a good stand of lespedeza without soil treatment. Chemical examination shows that the Newton soil is much more depleted in calcium, and hence more acid, than the Elizabethtown soil (Table 3, page 313).

Good Drainage Necessary for Best Yields.—Altho lespedeza grows better than alfalfa on soils that are not well drained, the best yields are obtained on areas where the drainage is good. In years when the spring rainfall is heavy, poorly drained soils frequently fail to produce a good stand of lespedeza. Even tho the stand is good early in the spring, the plants may die at an early age if the weather is warm and the soil wet. Under these conditions lespedeza, particularly Korean, is susceptible to severe injury from the "damping-off" fungus. Lespedeza is able to survive year after year only on well-drained areas.

ADAPTATION OF DIFFERENT VARIETIES

Seed Yield Tests

Northern Illinois.—Only the very early strains of lespedeza—Harbin, Common 81742, and Strain 59379—have produced sufficient seed for reseeding in the northern region of Illinois. Korean produced a trace of seed at the DeKalb experiment field during the late season of 1932, when no killing frost occurred until November 11. A trace was also produced at Dixon in 1933. Korean produced considerable seed two years out of three at Aledo (1931-1933), yet reseeding in addition to self-seeding following the late season of 1932, when seed production was good, gave an increase of 1,171 pounds of hay an acre (Table 13). The late varieties—Tennessee 76, Kobe, and Common—have not produced seed during the five years that they have been under observation at DeKalb; neither have they produced more than a trace of seed on the Dixon and Aledo fields during two and three years observation respectively. Sericea 12087 has frozen out almost entirely on the three northern experiment fields—DeKalb, Dixon, and Aledo—where it has been tried. Sericea 04730 has been seeded but no results are yet available.

North-Central Illinois.—The very early strains of lespedeza, such

as Harbin, matured their seeds so early in the north-central region of the state that they fell to the ground and germinated with the fall rains only to be killed by the first freeze. Korean lespedeza has produced considerable seed in this region, yet reseeding has given slight increases in hay yields over self-seeding (Table 13). Data are insufficient to state definitely how much seed must be produced to give a full volunteer stand the next year.

TABLE 13.—ACRE-YIELDS OF HAY OF SEVERAL VARIETIES OF LESPEDEZA FROM RESEEDED AND FROM SELF-SEEDED STANDS ON EIGHT EXPERIMENT FIELDS, 1933 AND 1934

Region, field, and year	Variety	Reseeded	Self-seeded	Difference[a]
		lbs.	*lbs.*	*lbs.*
Northern				
Aledo, 1933	Korean	2 486	1 315	+1 171
	Tennessee 76	1 238	0	+1 238
	Kobe	1 114	Trace	+1 114
	Common	662	0	+ 662
North-central				
Clayton, 1934	Korean	2 144	1 953	+ 191
Hartsburg, 1933	Korean	2 400	2 280	+ 120
Urbana, 1933	Korean	1 433	1 041	+ 392
Urbana, 1934	Korean	3 555	3 314	+ 241
Urbana, 1934	Tennessee 76	3 264	2 522	+ 742
Urbana, 1934	Common	3 306	3 312	− 6
South-central				
Alhambra, 1933	Korean	1 200	936	+ 264
Newton, 1934	Korean	2 815	3 960	−1 145
Southern				
Enfield, 1934	Korean	3 952	4 120	− 168
Unionville, 1934	Korean	1 260	1 980	− 720

[a]Plus sign (+) indicates advantage for reseeding.

Tennessee 76 and Kobe have produced a little seed some years, yet stands from self-seeding have not been maintained, apparently because of the small amounts of seed produced. Tennessee 76 matures the latest of the commercial varieties and ordinarily produces the least seed. At Urbana in 1934 a reseeding of Tennessee 76 gave a marked increase in yield of hay; smaller increases were obtained by reseeding Korean and no increase by reseeding Common. The Common variety sown in a row has self-seeded and maintained a stand for five years.

Sericea 12087 has frozen out almost completely in north-central Illinois. Of 300 plants set in hills in the spring of 1932 and kept free from weeds, only 20 plants remained the following spring. None of these survived the next winter. Sericea 04730 in rows survived remarkably well, while Sericea 12087 froze out extensively in rows and in hills. Where Sericea survived, seed production was good.

South-Central Illinois.—The very early strains have not been tested in the south-central region. They would probably not be able to perpetuate themselves, however, because, as in the north-central region, the seeds would be likely to germinate following maturity and the seedlings be killed by early frosts.

Korean has produced sufficient seed each year to maintain a stand. Six observations during 1932-1934 on the three experiment fields in this region indicate that Common will maintain a stand but that Kobe and Tennessee 76 will not produce enough seed every year for self-seeding. These borderline varieties are always handicapped in seed production the first year if too low a rate of seeding is used. Kobe and Tennessee 76 have not produced enough seed, in this general region, to volunteer a good stand from the initial seeding in more than one trial out of four.

Sericea 12087 has been tried only two years at Alhambra. It survived the first winter very well but froze out almost completely the second winter. Sericea 04730 survived one winter, after which the field was plowed.

Southern Illinois.—The very early varieties have not been tested in the southern region. Korean and Common have produced an abundance of seed for self-seeding. Tennessee 76 and Kobe have matured sufficient seed to maintain a stand most of the time. Sericea 12087 seems to be winter-hardy, as shown by the fact that the original seeding made in 1927 at the Elizabethtown experiment field is still good. Sericea 04730 has been seeded but as yet definite results are lacking.

State as a Whole.—Very early varieties, such as Harbin, will maintain a volunteer stand thruout the northern part of the state but are too early maturing for the rest of the state.

Korean is adapted from north-central Illinois south, and Common from the central part of the state to the southern end.

Tennessee 76 and Kobe are fairly well adapted to south-central Illinois but find their best environment in southern Illinois.

Sericea 04730 promises to be adapted in the south-central and southern regions, while Sericea 12087 is winter-hardy only in the southern region.

Hay Yield Tests

Northern Illinois.—At the Aledo experiment field in northern Illinois Korean has given the best hay yields (Table 14). At the DeKalb field Korean yielded 1,921 pounds of hay in 1932; at Dixon

TABLE 14.—ACRE-YIELDS OF HAY OF SEVERAL VARIETIES OF LESPEDEZA GROWN ON ALEDO AND URBANA EXPERIMENT FIELDS, 1932-1934
(Dark-colored soils of high productivity)

Field and year	Korean	Tenessee 76	Kobe	Common	Harbin 65280	Strain 59379
Aledo, northern	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1932	1 997	1 152	1 622	1 258	.....	.....
1933	2 486	1 238	1 114	662	.....	.....
1934	3 552	840	1 008	552	.....	.....
Urbana, north-central						
1933[a]	2 063	.....	2 157	1 459	.....	.....
1933[b]	1 701	2 851	3 135	2 346	490	452
1934[a]	3 434	2 893	3 432	3 309	1 971	1 519

[a]Second-year stand. [b]First-year stand.

1,800 pounds of hay in 1930, and at Kewanee 1,511 pounds of hay in 1934. No yields were taken from the very early strains, such as Harbin, because of poor stands, nor from Sericea because of complete winterkilling.

North-Central Illinois.—The season and the seeding practice has much to do in determining the high-yielding variety for any one year in the north-central region. Kobe led Korean in 1933 by a significant margin in a first-year stand at Urbana. In a second-year stand in 1933 and in 1934 the two varieties were about equal in yield (Table 14). In 1933 Korean led the late varieties by a wide margin at Hartsburg. The data suggest that Korean will yield better than the late varieties when self-seeded, but when the late varieties, Tennessee 76 and Kobe, are reseeded each year they will compare favorably with Korean. Common lespedeza appears to yield less than the other

TABLE 15.—ACRE-YIELDS OF HAY AND SEED OF SEVERAL VARIETIES OF LESPEDEZA GROWN ON THE ELIZABETHTOWN AND ALHAMBRA EXPERIMENT FIELDS, 1932-1934

Field, series, and year	Korean		Tennessee 76		Kobe		Common		Sericea	
	Hay	Seed	Hay	Seed	Hay	Seed	Hay	Seed	Hay	Seed
Elizabethtown, southern[a]	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1932[b]	1 409	340	.....	...	2 153	593	.....	...	1 984	943
1933	2 126	38	1 025	89	2 496	230	970	139	2 000	270
1934	2 432	307	1 663	229	859	177	1 268	241	.....	255
Alhambra, south-central[c]										
First series										
1932	2 798	344	5 009	63	4 695	25	4 362	38	7 760	713
1933	1 068	...	1 825	...	2 089	...	1 170	...	[d]	[d]
Second series										
1933	2 173	434	2 993	101	1 308	79	2 929	189	[e]	[e]
1934	4 201	1 088	1 609	58	1 613	399	1 337	264	[e]	[e]

[a]Yellow hilly land of low productivity. [b]Seeded with a nurse crop of oats. [c]Dark-colored soil of moderate productivity. [d]Winterkilled badly. [e]Poor stands.

late varieties except when self-seeded. In the north-central region hay yields of the very early varieties have been low. Hay yields have not been obtained from Sericea because of winterkilling.

South-Central Illinois.—The variety ranking highest in yield of hay has varied with season and seeding practice in south-central as in north-central Illinois. In 1932 at Alhambra the late varieties gave the highest yields, with Tennessee 76 leading. In 1933 on two series the differences were less marked, yet the late varieties averaged better than Korean, with Tennessee 76 again ranking first. In 1934 Korean was the highest yielding variety (Table 15); its record that year was due in part to a better stand, the better stand resulting from its more profuse seeding. At Oblong in 1933 the late varieties yielded somewhat better than Korean. The very early varieties have not been tried in this region. One year's results with Sericea at Alhambra showed it to be a high-yielding hay variety.

Southern Illinois.—Korean maintained a slight margin as a hay crop over the late varieties at the Elizabethtown experiment field in southern Illinois (Table 15) and also at West Salem and Raleigh. The higher yields of Korean, compared with the late varieties, were due largely to better stands. The yields of Sericea at Elizabethtown have been as good as those of Korean (Table 15). The very early varieties have not been tested in southern Illinois.

State as a Whole.—The very early varieties, such as Harbin, compare favorably with Korean for hay production only in the northern part of Illinois. From north-central Illinois to the south end of the state Korean yields better than the early varieties, particularly when self-seeded. Tennessee 76, Kobe, and Common do better in the southern part of the state than farther north; they can compete with Korean if reseeded each year when seed production is insufficient to self-seed a full stand. Tennessee 76 and Kobe are about equal in hay production and are better than Common. High yields of Sericea have been obtained only in the southern half of the state.

Varieties Recommended for Hay and Seed

The ability of a variety to produce sufficient seed for self-seeding in any region depends upon the fertility of the soil (Tables 5 and 6, page 314), the climatic conditions, and the nature of the variety. Korean, being less acid-tolerant than the three late varieties, responds more readily to soil treatment. It also seems to be more drouth-resistant than Tennessee 76, Kobe, and Common, as judged by better stands during the dry spring of 1934.

In the light of present experimental data and general observations, the following recommendations are made with respect to varieties that are suited to the various parts of Illinois. Further experiments and the development of new strains may of course make it necessary to revise from time to time any recommendations that might be made.

For northern Illinois the very early varieties, such as Harbin, are recommended for trial. Limited data indicate that the yields even of this variety will be low. When a variety is desired for forage or green manure for only one year, Korean is also suggested.

For north-central Illinois Korean is suggested as the best variety because of its ability to seed itself. The late varieties, Tennessee 76 and Kobe, may be used for a one-year crop.

For south-central Illinois Korean is recommended because of its high hay and seed yields. The late varieties, Tennessee 76 and Kobe, will also do well if reseeded each year. Only the winter-resistant strain of Sericea (04730) should be tried.

For southern Illinois all varieties except the very early strains are recommended. When pasture or seed is desired, Korean is to be preferred. The late varieties, Kobe and Tennessee 76, are both good for hay production. Both strains of Sericea are promising.

RESPONSE OF LESPEDEZA TO SOIL TREATMENT

Lespedeza makes its best yields on soils of high productivity, as do most other crops. On soils that have too low a nutrient-supplying power, little or no growth will result. When seeded on poor or on moderately productive soils, lespedeza is highly responsive to proper soil treatment (Tables 3, 4, and 12, pages 313, 314, and 323). The application of limestone, phosphate, or potash, singly or in combinations, and the inoculation of seed may be necessary to obtain the best results with lespedeza.

Limestone Improves Yields on Acid Soils

Before lespedeza is seeded tests should be made to determine the acidity of the soil[a] and limestone should be added as necessary. Altho

[a]Full directions for making soil-acidity tests are given in Circular 346, "Test Your Soil For Acidity," by C. M. Linsley and F. C. Bauer. A copy of this circular may be had by writing to the Illinois Agricultural Experiment Station, Urbana, Illinois.

lespedeza is more acid-tolerant than the other commonly grown legumes, little growth is likely to result on a strongly acid soil (see pages 322 and 323). On highly acid soils the application of limestone becomes one of the most important soil treatments in the growing of lespedeza.

Phosphorus Occasionally Necessary

According to chemical analysis, lespedeza is richer in phosphorus than is sweet clover, alfalfa, clover, or soybeans (Tables 9 and 10, page 316). Lespedeza will, however, grow on soils too low in available phosphorus to grow other legumes successfully, as it can apparently utilize the less available sources of phosphorus in the soil. Phosphatic fertilizers may not, therefore, give very striking effects with lespedeza. Phosphates used in addition to limestone and organic matter on southern Illinois experiment fields gave only slightly higher yields of lespedeza hay, as an average of sixteen crops spring-seeded in wheat, than did limestone and organic matter (Fig. 15, page 324). There are soils, however, that are not able to supply phosphorus satisfactorily to lespedeza. Additions of rock phosphate or superphosphate to such soils will cause good increases in the growth of lespedeza if other conditions are favorable (Fig. 16.)

A soil test for available phosphorus should be made at the same time the soil-acidity test is made. The method of testing for phosphorus is outlined in Illinois Circular 421.[a]

Potash Effective on Some Soils

The application of potash in addition to crop residues, limestone, and phosphate on experiment fields in southern Illinois increased yields of lespedeza 141 pounds an acre compared with yields when residues, limestone, and phosphate were applied without potash (Fig. 15). Few experiments have been conducted in Illinois where potash has been used in the absence of limestone. The Newton experiment field includes some unlimed plots that have received both phosphate and potash. In 1934 these plots produced .46 ton of hay and 114 pounds of seed an acre. Plots which had received 3 tons of limestone an acre in addition to phosphate and potash produced 1.67 tons of hay and 647 pounds of seed an acre.

It would appear from these results that neither phosphorus nor

[a]A copy of Illinois Circular 421, "Testing Soil for Available Phosphorus," may be had by writing the Illinois Agricultural Experiment Station, Urbana, Illinois.

potassium is as important as limestone in growing lespedeza. Apparently these elements need not be given attention until the lime deficiencies have been met.

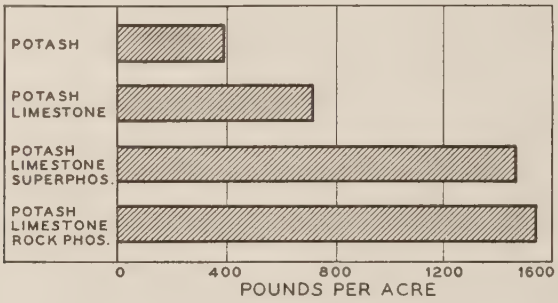

FIG. 16.—EFFECT OF PHOSPHATE FERTILIZERS ON YIELDS OF KOREAN LESPEDEZA HAY

Lespedeza responds well to phosphates on phosphorus-deficient soils when other nutrients are not limiting factors. The above graph represents results from the Ewing experiment field, southern Illinois, in 1933-1934.

Inoculation Essential

Where the soil contains no lespedeza nodule-forming organisms, inoculation is of great importance in growing lespedeza. In a large part of southern Illinois where cowpeas are grown and where Common lespedeza grows wild, the lespedeza nodule-forming organism, which belongs to the cowpea group of nodule bacteria, may be present in the soil. Consequently the inoculation of lespedeza has given beneficial results less frequently in southern Illinois than in other parts of the state.

In areas where cowpeas are not grown frequently and where Common lespedeza does not grow wild, inoculation will materially increase the yield (Fig. 17).

Hay yields from inoculated seed on the Urbana field in 1933 were 232 percent higher on limed land and 362 percent higher on unlimed land (Table 16) than were yields from uninoculated seed. The hay yields from inoculated seed on unlimed land were higher than those from uninoculated seed on limed land. Altho the total yields on this field were low because of unproductive soil and the dry season, the advantage of inoculation is marked.

Some investigators believe that the different lespedezas require different kinds of nodule bacteria for nodulation. This belief is based

primarily on the observation that Korean and Common lespedezas growing in the same area sometimes show differences in nodulation, Korean producing few nodules and Common showing good nodulation. Illinois experiments indicate that this situation is probably due to conditions other than a difference in nodule-bacteria requirements.

Four different lespedezas—Korean, Common, Kobe, and Tennessee 76—were inoculated at the Illinois Station in 1934 with three

FIG. 17.—UNINOCULATED AND INOCULATED FIELDS OF KOREAN LESPEDEZA

Where suitable nodule bacteria are not already present in the soil, the inoculation of lespedeza seed is profitable. Uninoculated seed produced the thin, weedy stand shown on the left; inoculated seed under the same conditions gave the pure thick stand on the right.

strains of nodule organisms isolated from cowpea nodules and four strains isolated from lespedeza nodules. All strains of nodule bacteria produced nodules in the greenhouse and in the field on the four varieties of lespedeza. The strains were not all equally effective when judged by growth and protein content of the plants, but the strains which were efficient on one lespedeza were efficient on all and those that were inefficient on one lespedeza were inefficient on all. Thus there was no indication that any one culture of nodule bacteria was specific for any one lespedeza.

Korean appears to be slightly less acid-tolerant than Common lespedeza, and this may explain why the two can grow in the same area and Korean produce few nodules and Common good nodula-

TABLE 16.—INFLUENCE OF INOCULATION ON ACRE-YIELDS OF KOREAN LESPEDEZA HAY GROWN ON LIMED AND UNLIMED SOILS, URBANA, 1933

(North-central Illinois, dark-colored soil of low productivity)

Seed treatment	Yields on limed soil	Yields on unlimed soil
	lbs.	*lbs.*
Inoculated	2 260	1 007
Uninoculated	681	218
Increase for inoculation	1 579	789
Percentage increase	(232)	(362)

tion. That nodulation on Korean is markedly affected by liming is indicated by the following data obtained at Urbana in 1934:

Pounds of limestone applied per acre	0	1,000	2,000	3,000	4,000	6,000	8,000
Percentage of plants with nodules	0	0	7	19	55	95	100

A high percentage of the Korean plants gave good nodulation on this acid soil only after limestone was applied.

CULTURAL PRACTICES

Quality of Seed

Guard Against Weedy Seed.—The source of lespedeza seed is important since much of it is produced in the South where dodder is prevalent. Twenty-five percent of the seed in a test made at the Louisiana Experiment Station[2]* in cooperation with the U. S. Department of Agriculture Seed Laboratory showed less than 90 percent purity. The most prevalent weed seeds in Illinois-grown seed are crab grass, ragweed, rough button weed, smartweed, spiny sida, sedge, witch grass, and dodder. Dodder is probably the most serious. Certified seed can be had that is dodder-free. Some growers believe that northern-grown seed is acclimated and therefore better adapted to the northern area of the lespedeza region. As a matter of fact, however, the crop probably has not been grown sufficiently long in the North to develop regional strains thru natural selection.

Hard Seeds Require Early Seeding.—Lespedeza contains a high percentage of hard seeds; sometimes over 50 percent of the smaller seeds are hard. Lots of large, medium-sized, and small seeds were tested for hardness at the North Carolina Station[5]* with the following results: large seeds, 1.8 percent hard; medium-sized seeds, 37.9 percent hard; small seeds, 58.8 percent hard. All sizes were equally viable.

TABLE 17.—EFFECT OF AFTER-RIPENING ON PERCENTAGE GERMINATION OF KOREAN LESPEDEZA SEED AT NORTH CAROLINA EXPERIMENT STATION,[a] 1931-1932

Month of germination following harvest	Germination	Hard seeds	Total viable
	perct.	*perct.*	*perct.*
November	46.70	47.25	93.95
January	83.30	12.25	95.55
March	84.85	11.05	95.90

[a]Work of G. K. Middleton reported by A. J. Pieters.[14]*

As an aid to germination of hard seeds, early seeding is recommended. Most of the seed of the annual varieties is sold in the hull so that scarification is not practical. The highest germination in experiments conducted in Louisiana[2]* and in North Carolina[7]* occurred during the late winter months following harvest. Immediately after harvest germination was poor because of hard seeds, but it increased rapidly from December to February. In Table 17 are reported results from the North Carolina experiments. The hard seeds gained in germination more rapidly than the other seeds lost viability, with the result that there was a higher germination of the sample as a whole in late winter.

TABLE 18.—SUMMARY OF GERMINATION RECORDS OF SEVERAL VARIETIES OF LESPEDEZA SEED OF DIFFERENT AGES, URBANA, 1934

Age of seed and variety	Number of samples	Germinated	Hard	Dead	Total viable
		perct.	*perct.*	*perct.*	*perct.*
One year					
Korean	20	71.9	8.6	19.4	80.5
Kobe	15	61.2	5.0	33.8	66.2
Common	11	76.5	2.3	21.2	78.8
Tennessee 76	3	66.7	2.0	31.3	68.7
Sericea	6	63.8	29.0	7.2	92.8
Two years					
Korean	3	76.0	8.7	15.3	84.7
Kobe	2	71.5	13.5	15.0	85.0
Common	1	78.0	0	22.0	78.0
Tennessee 76	2	90.5	2.0	7.5	92.5
Sericea	8	23.9	66.0	10.1	89.9
Three years					
Korean	6	82.3	6.0	11.7	88.3
Kobe	4	69.0	11.0	20.0	80.0
Common	2	77.5	5.5	17.0	83.0
Tennessee 76	2	81.5	2.0	16.5	83.5
Four years					
Korean	2	63.5	28.5	8.0	92.0
Five years					
Common	1	60.0	7.0	33.0	67.0
Six years					
Korean	2	58.5	22.0	19.5	80.5
Common	1	79.0	0	21.0	79.0

Germination Tests Important.—Conflicting data from germinator tests have been obtained at the Illinois Station (Table 18). Since the tests were not made on the same samples for the entire period, but for different samples of different ages, study of loss of viability was not possible. Some of the two- and three-year-old samples germinated well, however. In tests at the Kentucky Station[6*] two- and three-year-old Korean seed showed between 80 and 95 percent germination. According to the Louisiana Station[2*] lespedeza seed loses its viability rapidly; three-year-old seed in their tests was dead and two-year-old seed not worth sowing. On the West Salem field in Illinois in 1928 Korean two-year-old seed failed to produce a stand.

In view of these discrepancies in observed viability the testing of seed for germination becomes highly important.

Purchase Seed on Weight Basis.—Lespedeza seed should be purchased by the pound as there is no established standard weight per bushel. Weight per volume varies with the variety. A limited number of samples of lespedeza seed taken at Urbana in 1934 varied as follows in weight per bushel:

Variety	*Pounds per bushel*
Korean	45
Tennessee 76	30
Kobe	24
Common	30
Sericea[a]	65

([a]Sericea hulled; all other varieties unhulled.)

Lespedeza Responds to Good Seed-Bed Preparation

When lespedeza is sown in small grain, no preparation of the seed bed is necessary if the soil has been well prepared for seeding the small grain. On sod land in pastures it is sometimes necessary to prepare the land by disking or harrowing, so as to permit the seed to come in contact with the soil. Altho sowing lespedeza on uncultivated land without preparation of the seed bed is often recommended, the U. S. Department of Agriculture has shown that the height of lespedeza plants may be increased considerably by good preparation of the seed bed.[1*]

Disking a one-year-old field of Korean lespedeza in the spring of the second year increases the yields markedly, according to data collected during two years at the Alhambra, Unionville, and Enfield experiment fields (Table 19). Because of wet weather, however, disking before the seeds germinate is not always possible.

In a year's trial at the Enfield experiment field the highest yields were obtained when the land was plowed and seeded to oats (Table 19). The time and depth of plowing and the kind of preparation given the seed bed after plowing have much to do with yields since covering seed too deep interferes with growth or prevents it entirely.

TABLE 19.—ACRE-YIELDS OF HAY RESULTING FROM DIFFERENT METHODS OF SEED-BED PREPARATION OF SELF-SEEDED KOREAN LESPEDEZA AT THREE EXPERIMENT FIELDS, 1933 AND 1934[a]

Field and seeding practice	No treatment	Disked	Disked and seeded to oats	Plowed	Plowed and seeded to oats
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*
Alhambra, south-central[b]					
Self-seeded	1 068	1 444	.....	.....	.....
Unionville, southern[c]					
Self-seeded	360	1 980	220	900[d]	.....
Enfield, southern[c]					
Self-seeded	2 103	4 442	.....	3 797	4 560
Reseeded	3 014	4 569	.....	3 334	5 057

[a]Alhambra, 1933; Unionville and Enfield, 1934. [b]Dark-colored soil of moderate productivity. [c]Yellow soil of low productivity but with good soil treatment. [d]Oats failed to produce a crop.

Method of Seeding

Lespedeza seed in the hull, as it is usually sold, is difficult to sow with a regular grass-clover drill or with a grass-clover attachment on a grain drill. The light, fluffy seed in the hull does not feed thru the drill uniformly. It can be sown to better advantage by hand or with a hand seeder. Some farmers have reported success in seeding with an end-gate seeder. Sericea seed is hulled and can be seeded the same as clover or alfalfa.

If lespedeza is sown with a drill, care should be exercised not to sow the seed too deep. Lespedeza does well if broadcasted early on top of the soil, with little or no attempt to cover the seed. In any event only a light covering is recommended.

Early Seeding Preferable

Lespedeza should be seeded as early as red clover when possible. When the crop is self-seeded, seeding takes place in the fall. The freezing weather aids in the germination of the hard seeds.

Some growers believe that unhulled seed could be seeded to advantage any time during the fall and winter months because of the high percentage of hard seeds and the inability of lespedeza to germinate at low temperatures. Experimental data on this point are

lacking. It must be borne in mind that an early seeding is subject to serious injury if freezing temperatures follow germination, as in 1932. One year's data on time of seeding, from two experiment fields, indicate that late seeding is less desirable than an early or medium time of seeding (Table 20). These data are not presented, however, as a basis for final conclusions.

When lespedeza is seeded late, frequently a poor stand is obtained early in the season, but the stand improves with the later germination

TABLE 20.—EFFECT OF TIME OF SEEDING ON ACRE-YIELDS OF LESPEDEZA HAY AND SEED AT THE RALEIGH AND WEST SALEM EXPERIMENT FIELDS, 1933

Field and variety	Hay yields			Seed yields		
	Early seeding	Medium seeding	Late seeding	Early seeding	Medium seeding	Late seeding
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Raleigh, southern[a]						
Korean	3 776	4 086	3 043	183	202	148
Tennessee 76	3 485	2 349	2 678	22	16	18
West Salem, south-central[b]						
Korean	1 183	1 291	888	...	...	...

Note.—Raleigh: *early*, March 15; *medium*, April 1; *late*, April 25. West Salem: *early*, March 2; *medium*, April 1; *late*, April 26.
[a]Gray soils of low natural productivity but with good soil treatment. [b]Yellow soil of low productivity with limestone treatment.

of the hard seeds. Farmers have occasionally plowed up fields that might have given good stands had they waited for complete germination. When lespedeza is self-seeded, the amount of seed is sufficient for the viable seeds to give a better early stand than that resulting from the original seeding. In volunteer seedings observed in Illinois the seeds began germinating in the middle of March in 1934 and in early March in 1935.

TABLE 21.—ACRE-YIELDS OF LESPEDEZA HAY AND SEED WITH DIFFERENT RATES OF SEEDING, RALEIGH EXPERIMENT FIELD, 1933
(Southern Illinois, gray soil of low natural productivity but with good soil treatment)

Variety	Hay yields			Seed yields		
	10-pound seeding	20-pound seeding	40-pound seeding	10-pound seeding	20-pound seeding	40-pound seeding
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Korean	3 725	4 086	3 430	215	202	228
Tennessee 76	2 263	2 349	3 088	7	16	35

Rate of Seeding Depends on Use

The rate of seeding, when a volunteer crop is desired, is light. Ten to 15 pounds an acre in small grain or in a pasture will produce a good self-seeded stand the second year.

To obtain a full stand the first year, a seeding of 20 pounds or more an acre is recommended (Table 21), and for seed production about 15 pounds an acre. Satisfactory stands have been reported, however, with lower rates of seeding than these.

Lespedeza Better Suited Than Other Legumes to Nurse Crops

No experiments have been made that test the value of different crops as nurse crops for lespedeza. Some observations from this Station indicate that lespedeza can compete more successfully with a heavy grain crop than can red clover or sweet clover. In very heavy grain, however, the lespedeza stand is often impaired and may be destroyed. Hay and seed yields of lespedeza were decidedly higher on the Clayton and Enfield experiment fields in 1933 and 1934 when no nurse crop was used than when oats were used as a nurse crop (Table 22).

TABLE 22.—ACRE-YIELDS OF HAY AND SEED OF KOREAN LESPEDEZA WITH AND WITHOUT A NURSE CROP OF OATS, CLAYTON AND ENFIELD EXPERIMENT FIELDS, 1933 AND 1934

Field and year	Without nurse crop	With nurse crop	Difference
	lbs.	*lbs.*	*lbs.*
Clayton, 1933, *north-central Illinois*[a]			
Hay	2 239	1 138	+1 101[c]
Seed	148	58	+ 90
Clayton, 1934			
Hay	3 398	1 483	+1 915
Seed	264	264	0
Enfield, 1933, *southern Illinois*[b]			
Hay	1 003	444	+ 559
Seed	.....	.....	.....
Enfield, 1934			
Hay, self-seeded	4 442	3 797	+ 645
Hay, reseeded	4 569	3 334	+1 235
Seed, self-seeded	708	668	+ 40
Seed, reseeded	572	784	− 212

[a]Dark-colored soil of moderate productivity. [b]Yellow soil of low natural productivity but with good soil treatment. [c]Plus sign (+) indicates advantage without nurse crop.

Lespedeza May Be Used in Mixtures

Lespedeza has done well when seeded with either biennial or annual sweet clover in wheat or oats on experiment fields in southern Illinois.

When sown in a mixture with other forage crops it has also done well, tho attempts to thicken an established stand of hay mixture have been unsuccessful. For the past two years good stands of lespedeza have been obtained at Urbana in thin stands of red clover when the lespedeza was sown early enough to compete with the clover crop (Fig. 18). In thick stands of clover, lespedeza has not survived.

FIG. 18.—KOREAN LESPEDEZA SEEDED IN A THIN STAND OF RED CLOVER

The lespedeza was seeded in the clover on May 9 at Urbana and was photographed September 21. The first crop of clover was harvested for hay without injury to the young lespedeza. The second growth of red clover, together with the lespedeza, makes excellent late summer and fall pasture.

Clipping for Weed Control

During its early stages lespedeza, like other legumes, is a poor weed fighter. Sometimes it is necessary to mow the field in order to control the weeds. At the Unionville experiment field in 1934, clipping increased the hay yields 200 percent and the seed yields 33 percent.

Weeds should be mowed late, with the cutter bar of the mower set high enough to avoid cutting the lespedeza. A weed-clipping attachment for the cutter bar will permit cutting at a height of 8 to 10 inches. Early and frequent mowing is not recommended. Any cutting of the lespedeza plants is detrimental. Mowing when the plants are

wet results in rotting of those injured by the mower wheels and the horses' hoofs.

After lespedeza gets well started, it is a good weed fighter.

Best Quality Hay Harvested in Bloom Stage

Annual lespedezas cut when in full bloom give a more palatable and nutritious hay with a higher percentage of leaves and protein and less crude fiber than when cut later.[a] The time to cut in order to obtain the highest hay yields is probably at the time of seed formation before there is any loss of leaves. Lespedeza hay contains a high percentage of leaves, as shown in Table 23.

In Illinois only one cutting of lespedeza hay from the annual varieties can be obtained each year, with the possible exception of crops

TABLE 23.—PERCENTAGE OF LEAVES AND OF STEMS OF SEVERAL VARIETIES OF LESPEDEZA HARVESTED ON THE ALHAMBRA AND URBANA EXPERIMENT FIELDS, 1934

Field	Korean		Tennessee 76		Kobe	
	Leaves	Stems	Leaves	Stems	Leaves	Stems
Alhambra, south-central[a]	60.0	40.0	61.2	38.8	59.5	40.5
Urbana, north-central[b]	65.9	34.1	59.0	41.0	61.9	38.1
Field	**Common**		**Harbin 65280**		**Strain 59379**	
	Leaves	Stems	Leaves	Stems	Leaves	Stems
Alhambra	60.0	40.0	....	....	....	....
Urbana	70.1	29.9	51.7	48.3	47.4	52.6

[a]Dark-colored soil of moderate productivity. [b]Dark-colored soil of good productivity.

grown in the extreme southern third of the state. With a longer growing season, two hay crops can be obtained, or one hay crop and then sufficient seed to volunteer a full stand the next year. When a volunteer crop is desired, hay harvest should be delayed until sufficient seed has been produced for self-seeding.

Because of their fine stems and low water content, lespedeza plants cure rapidly; and because of the extreme thickness of a good stand of lespedeza, hay yields are greater in proportion to the height of the plants than they are with most forage crops.

[a]Tentative standards for use in the grading and marketing of lespedeza hay were issued in mimeographed form by the U. S. Department of Agriculture Bureau of Agricultural Economics in November, 1934.

When Sericea lespedeza was cut only once a year in experiments conducted by the U. S. Department of Agriculture, reported by A. J. Pieters,[14]* the highest yields and the largest amounts of protein were obtained from late cuttings, but the percentage of protein decreased and the crude fiber increased with delayed harvest. When two cuttings were made, higher percentages of protein and lower percentages of crude fiber were obtained from the earlier cuttings. In experiments at the Ohio Station[13]* higher yields and higher total amounts of protein an acre were obtained from two annual cuttings made the latter part of June and in September.

If the second crop of Sericea is to be used for seed, the best results may be obtained by cutting the hay crop early.

Harvesting Seed

The early method of harvesting lespedeza for seed was by the "pan method." In this method a large galvanized iron pan equal in length to the cutter bar is attached to the cutter bar of the mower. A slotted or perforated cover permits the shattered seeds to be caught

FIG. 19.—HARVESTING KOREAN LESPEDEZA SEED WITH COMBINE HARVESTER

Korean lespedeza may be conveniently harvested with a combine harvester. The "pick-up" attachment on the combine shown above takes up practically all the lespedeza which has been windrowed previously with the side-delivery rake. Straw may be baled at the time of seed harvest for use as forage.

as the hay passes over the pan. These seeds are of the highest quality. If cut early, this hay makes excellent feed.

When harvested primarily for seed, lespedeza is usually raked when damp and later threshed with a common grain separator, sometimes provided with a lespedeza attachment.

The combine has been used successfully in harvesting lespedeza seed. The field may be mowed and raked with a side-delivery rake and then threshed with a combine which has a "pick-up" attachment (Fig. 19). When the plants are very short, a special lespedeza cutter bar may be used that cuts close to the ground. With any method, sufficient seed is shattered to reseed the field the following year.

PESTS OF LESPEDEZA

Weeds Are Worst Enemy

Of the few pests of lespedeza, weeds are the most important. Weeds are found in poor stands of lespedeza, in lespedeza seeded on foul land, and where impure seed has been used.

When a thick stand is obtained in early spring, weeds seldom give trouble (Fig. 20). This fact emphasizes the importance of a high rate of seeding when lespedeza is sown alone and of early seeding. Self-seeded stands are usually much more free of weeds than original seedings, because of the heavy stands of early growth in self-seeded stands.

Foul land should not be seeded to lespedeza when it is possible to free it of some of the weeds thru cultivation. Land that is foul with annual weeds will gradually give less competition from weeds when the lespedeza is permitted to reseed itself year after year.

Dodder is probably the worst weed pest of lespedeza. It is a plant parasite which starts from seed, and after attaching itself to the lespedeza releases itself from the soil and continues to draw its nourishment from the host plant. Fields of lespedeza badly infested with dodder are not only worthless but are a source of trouble for many years since the dodder seed will remain viable in the soil for a long time. If clover or lespedeza is brought back to the land, the dodder will again give trouble.

It is very difficult to separate dodder seed from lespedeza seed. According to the Illinois seed law[a] badly infested seed is not salable in the state. Since the purchase of lespedeza hay containing dodder plants will be a source of new infestation, such hay will not find a ready market.

Dodder is a southern weed and will give the greatest trouble in the southern half of Illinois. Likewise the farther south the origin of

[a]Illinois Seed and Weed Control Laws. Illinois State Department of Agriculture Bulletin 330. 1931.

lespedeza seed or hay, the higher the percentage of dodder it is likely to contain unless special care is taken to keep the fields free from it.

Mowing and burning of dodder-infested areas is recommended. A blow torch is sometimes used to eradicate small scattered spots of this pest. On farms where dodder has not yet gained a foothold, much

FIG. 20.—A THICK STAND OF LESPEDEZA CONTROLS WEEDS

An early growth of a thick stand, which a volunteer seeding furnishes, enables the lespedeza to gain possession of the soil, thus preventing weed development.

trouble can be prevented if the grower will refuse to buy infested seed or hay.

Ragweed, rough button weed, crab grass, witch grass, smartweed, muletail, and plantain are frequently found in lespedeza fields. Clipping is recommended for the control of these annual weeds (page 340). Most of them are a common impurity of the lespedeza crop wherever grown and should be guarded against in the purchase of seed or hay.

Insects Cause Little Damage[a]

Observations for some time on lespedeza fields in Illinois have disclosed little or no damage from insects. Grasshoppers, leaf hoppers, and web worms feed on the plant to a slight extent but have not yet caused anything that could be termed commercial damage. So far, the plant in this state has been remarkably free from insect injury.

Crop Relatively Disease-Free[b]

Lespedeza is relatively free of disease in Illinois. In the spring, during continued wet weather, a fungus disease known as "damping-

FIG. 21.—LEAF-SPOT DISEASE OF LESPEDEZA

Following a rainy period in the late summer of 1934, a leaf-spot disease of lespedeza became very prevalent in early September. Another appearance of the disease was noted in June, 1935, following a wet spring. The height and vigor of the plants were materially affected, as evidenced by a comparison of the diseased plants at the left with the healthy ones at the right. The disease did not affect Korean or Harbin but did affect Common, Kobe, and Tennessee 76.

off" may attack and kill the growing seedlings, thereby causing a poor or uneven stand. In pot cultures in the greenhouse Korean has been

[a]Statement contributed by W. P. Flint, Chief Entomologist, Illinois State Natural History Survey, and Entomologist, Illinois Agricultural Experiment Station.

[b]Statement contributed by Benjamin Koehler, Associate Chief in Crop Pathology, Illinois Agricultural Experiment Station.

much more susceptible to this disease than have the other annual varieties.

A leaf-spot disease of lespedeza has been observed but not studied (Fig. 21). In the wet fall of 1934 and the wet spring of 1935 this disease was prevalent on Common, Tennessee 76, and Kobe, but did not appear on Korean, Harbin, or Sericea.

An occasional yellowing of Sericea plants has been observed, but the cause is not definitely known.

SUMMARY AND CONCLUSIONS

Because of its value as a hay and pasture crop, its relative acid tolerance, its drouth resistance, its relative freedom from insect and disease pests, and its low cost of seeding, lespedeza is entitled to an important place in Illinois agriculture. Investigations conducted during the past thirteen years at the Illinois Agricultural Experiment Station lead to the following conclusions:

1. Altho there is no area in Illinois where some variety of lespedeza will not do well, this crop finds its best adaptation in the southern half of the state. It is drouth resistant and heat resistant, but it is sensitive to freezing weather in early spring and late fall and gives best yields where there is at least a moderate supply of moisture.

2. There is no reason why lespedeza should replace other well-known legumes. Its special value lies in its ability to grow and produce a good stand under conditions in which alfalfa, red clover, and sweet clover will not grow or grow unsatisfactorily.

3. Of the annual lespedeza varieties, Korean appears in general to be the most desirable for Illinois, altho under some conditions, Tennessee 76, Kobe, and Common may be preferable. In the northern section of the state Harbin is the only commercial variety that may be expected to produce sufficient seed for self-seeding. Sericea, a perennial lespedeza, shows promise as a hay crop in most of the southern half of the state. Further studies will be required to establish the extent of its adaptability.

4. Lespedeza grows more satisfactorily on poor and acid soils than most other legume crops suitable for pasture. It is at its best, however, on productive, well-drained soils that are not acid.

5. When lespedeza is grown for the first time, care must be given to thoro inoculation. This is true at least in the northern three-fourths of the state. Inoculation is often profitable in the southern section also.

6. On acid soils lespedeza shows a marked response to the appli-

cation of limestone. It also responds well to phosphorus and potassium applications on soils low in these elements.

7. Lespedeza, like most cultivated crops, responds favorably to proper cultural practices, such as good seed-bed preparation, correct time and rate of seeding, and clipping for weed control.

8. Lespedeza finds its widest use as a pasture crop, seeded either alone or in pasture mixtures. It makes a good quality of hay, however, that compares favorably with alfalfa when judged by chemical analyses, by palatability, or by meat and milk production.

9. The growth habits and other characteristics of lespedeza give it special value as a soil-improvement crop. Where it is well adapted, it serves as a green-manure crop and provides good protection against soil erosion.

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